KamLAND Calibration and Monitoring Source Deployment

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In order to best understand the behavior, and properly interpret the results of the KamLAND detector, a thorough calibration of its response must be performed. This calibration is expected to require placing sources of known energy, light intensity or timing throughout the volume of the detector. Two systems are being designed for deployment of the calibration sources.

For a very detailed study of the detector where the response throughout the whole central volume would be mapped out, a system which will allow a source to be placed anywhere in the central volume will be used. Currently a system consisting of a telescoping mast with attached arm is envisioned. Depending upon how the mast is rotated, and how the arm is extended, almost all locations in the central scintillator volume of the detector will be accessable.

Two options are under consideration for the arm which extends from the mast. In the first scheme, the arm is composed of two segments with a pivot joint half way along the full extention of the arm. The arm segments would move in a plane aligned with the telescoping mast, and the source would reside at the end of the arm. The second scheme consists of a telescoping boom which can pivot in a plane with the mast. In this scheme, the source would be lowered from a cable at the end of the boom.

While a mast and arm deployment will allow for a careful study of and spatial variations of the detector response, it is anticipated that most of the calibration type activities which will be performed will be for the purposes of monitoring changes in the detector response. These activities will consist of some calibrations which are performed on a regular, frequent basis. For these calibrations a simpler scheme of a source passed down the vertical axis of the detector on the end of a cable is envisioned. This scheme will have the sources deployed and retracted with a winch which resides inside of a glove box resting on top of the detector. The ability to select different positions along the z-axis will allow for testing of some position dependent characteristics of the detector.

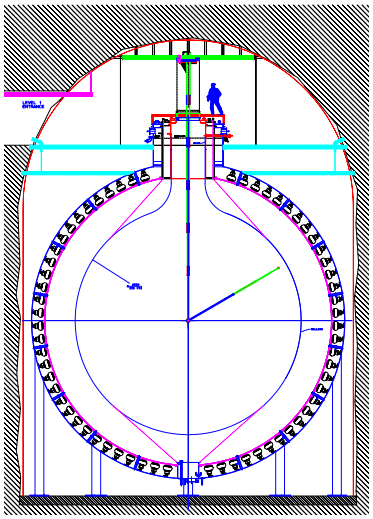

Figure 1: Figure shows the calibration source deployment arm concept.

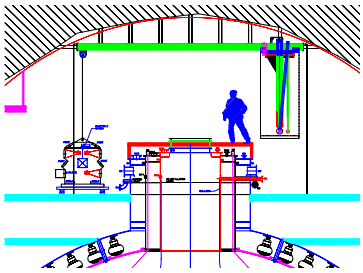

Figure 2: Figure shows both the calibration source deployment systems in their stored positions.

The deployment systems must be built so that they are light-tight to prevent damage to the PMTs in the detector. They must also be gas-tight to prevent the introduction of radon into the detector volume. In addition to these requirements, the deployment devices have been designed so that they may be removed and stored to the side as access to the central volume of the detector will be restricted to a single $1.5m$ diameter port.